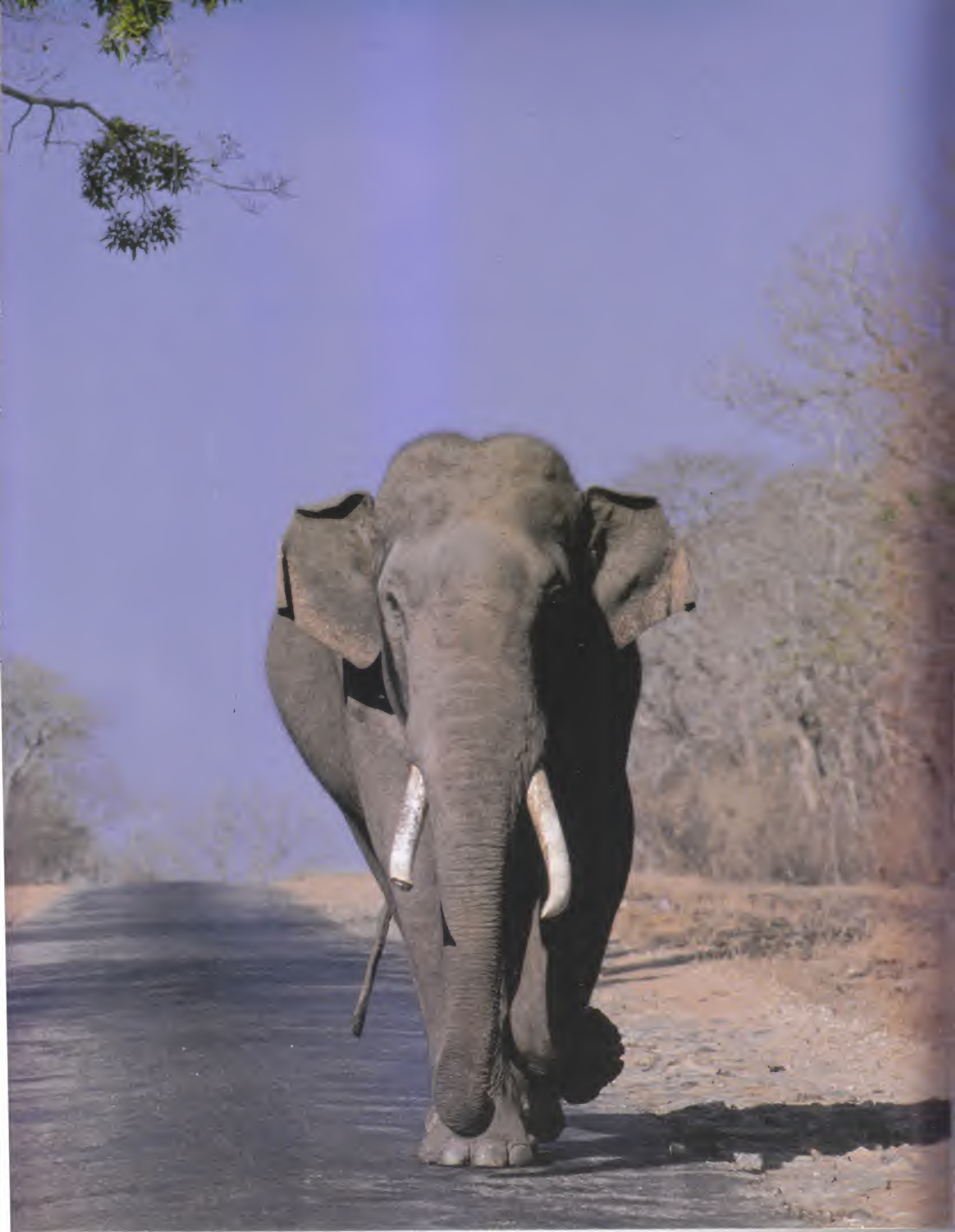


A low-angle photograph of a large elephant, likely during a festival or religious procession. The elephant's trunk is prominently featured in the foreground, adorned with large, ornate metal rings. The elephant's body is covered in intricate, colorful patterns painted in white, yellow, orange, and green. A person wearing a blue turban and a red garment is visible on the elephant's back. The background shows a bright blue sky with scattered white clouds. The overall scene is vibrant and celebratory.

*Nature's
Masterpiece*

The Elephant



*Nature's
Masterpiece*

The Elephant

Input by :

Ajay A. Desai
Wildlife Biologist

In commemoration of the 10th year of
PROJECT ELEPHANT



Karnataka Forest Department
October 2001

Nature's Masterpiece, **The Elephant**

In commemoration of the 10th year of
PROJECT ELEPHANT

**KARNATAKA FOREST DEPARTMENT,
WILDLIFE WING**

Published : October 2001

No. of pages : 48 + 4

No. of copies : 3000

Pictures : Krupakar Senani

Published by : **S.K. Chakrabarti**, I.F.S.
PCCF, Wildlife
Aranya Bhavan, 2nd Floor,
18th Cross, Malleshwaram,
Bangalore - 560 003,
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Cover picture : The most magnificent Drona, who used to carry the Golden Howdah
at the Dasara festivities in Mysore.

Prepress : Scan Line, Bangalore. Tel. 080-3204144, 3387106

Printed at : Rajhans Enterprises, Bangalore - 560044
Tel. 080-3357070



... First worshipped, then sacrificed ...

It is said that the Gods once lived on Earth like earthlings. All the creatures lived in peace and enjoyed Nature's bounty alike. Until...

...Man appeared on Earth to disturb the tranquillity.

The Gods were worried. They gathered to discuss their future on Earth. The unanimous conclusion was that Earth was no longer a safe place for them, and that they should set off to another world with bag and baggage. Man, they decided, was a dangerous fellow.

Even as they were passing the resolution, a herd of elephants came by. When the latter wanted to know what the commotion was all about, the Gods decided to let them in on their fears. "Why don't you come with us? We will go to another world and live happily", the Gods suggested to the elephants.

The elephants refused outright. "Why should we be scared of a tiny creature like the human being? Besides, who would want to leave our beautiful Earth, the skies, the forests, the flowers and the rivers?", they argued.

The Gods were angry. "You are destined to stay here and throw mud on yourselves", they said, and went off to Heaven.

This is only a folk tale. But it jolts me when I realise how true it rings now.

As you might know, the elephant is an endangered species. Our forest cover, for many reasons, has shrunk over the years. What is more, poachers are taking a toll on elephants.

This is a serious issue.

And that in a land whose culture is so strongly linked to the elephant.

From the Indus valley to the Ajanta caves, elephants lent wings to Man's artistic imagination. They expanded the horizons of literature in the writings of Valmiki, Vyasa and Kalidasa. Contrary to the elephant's philosophy, they went to the battlefield, and helped expand Emperor Jehangir's kingdom.

Closer to the present, they obey orders given by man to fell trees, and load them onto trucks as timber (it is an irony that they silently obey orders that destroy their own home). Though they are extremely private animals, they entertain man in crowded circuses. Though the loud applause and whistles hurt their sensitive ears, they – like Mahatma Gandhi – have tread the path of tolerance and non-violence.

Fulfilling Man's wish, the elephant became Ganesha in the sanctum sanctorum of temples – speechless, motionless.

Yes. Let the elephant not end up only in the sanctum sanctorum built by man. Or, in a future folk tale, let not the elephant go away with the Gods to a different, peaceful world.

The elephant should roam the forests forever and lend its beauty to Nature. May their trumpeting resound in valley after valley, and establish their rule over the forest. Let not the elephant's footprints fade away from the forests.

Only if we ensure this, will we – humans – be able to give ourselves the credit of preserving a glorious tradition.

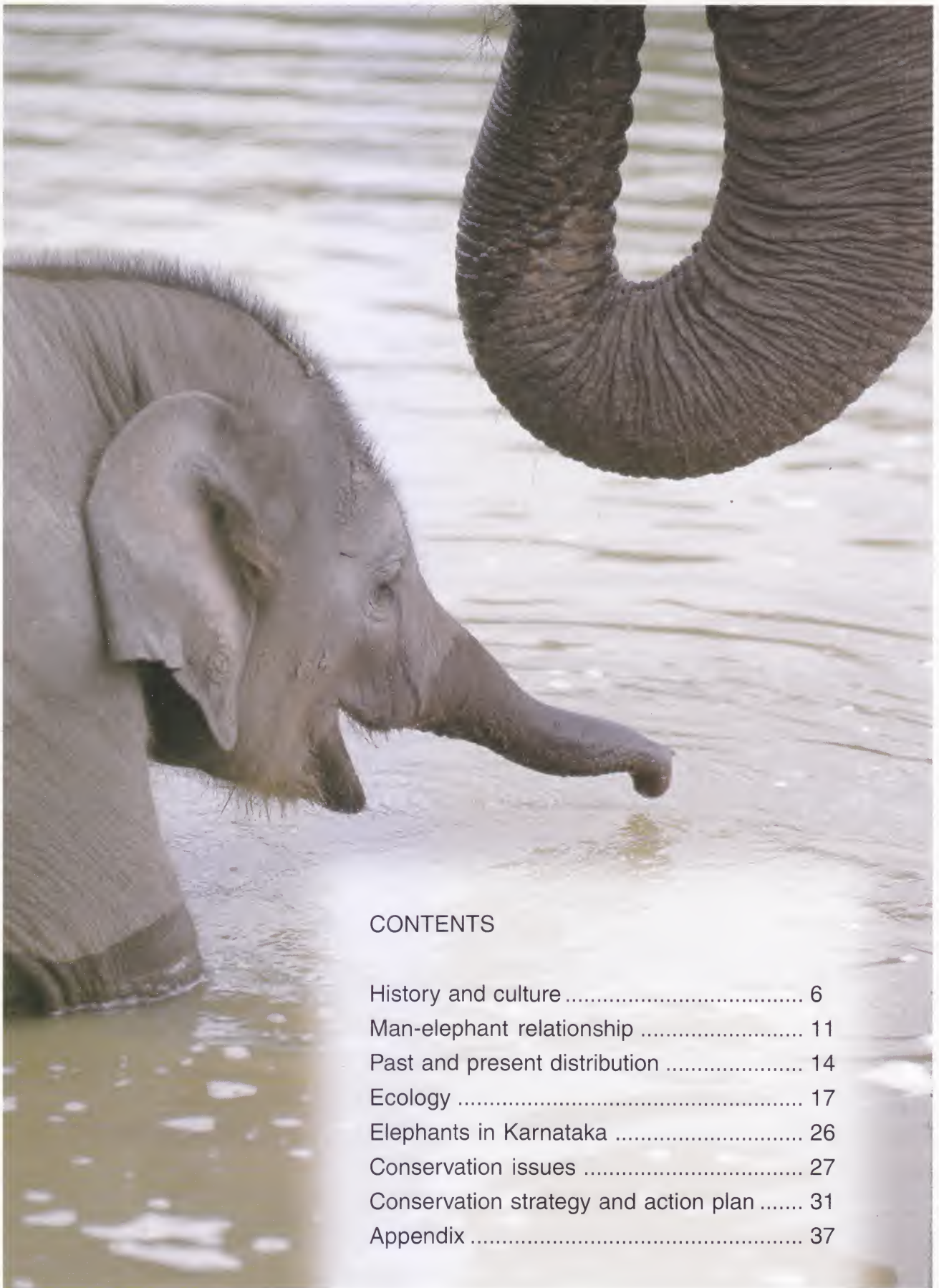
There cannot be a better occasion than this to share these thoughts with you; this is the tenth year of the Project Elephant. It is in this light that I present this compilation of the elephant's history, their present status, scientific studies, pictures and writings on the elephant.

This occasion should not stop at being a symbolic celebration of the elephant. I believe that our efforts at conserving the elephant can be deemed a success if this book can create that awareness among us.



S. K. Mahabarti

PCCF, WILDLIFE.



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History and culture

Although elephants evolved in Africa 55 million years ago, the Asian elephant (*Elephas maximus*) is much more deeply etched in the history and mythology of Asia, than is its cousin, the African elephant (*Loxodonta africana*), in Africa. The Asian elephant, considered a symbol of fertility, wealth and abundance, has a long history of domestication in India, as is evident from sculptures, paintings, seals and coins, dating back as far as the Harappan civilization of 2500-1500 BC.

To most Westerners, the elephant and India are inseparable. This is not surprising, considering the fact that Indian folklore abounds with elephant tales.

One legend has it that the primeval elephant could fly. Once, while alighting on a tree in the Himalaya,

one elephant broke off a branch, which fell on a sage's hermitage. The angry sage put a curse on the elephants, so that they lost their power of flight. Brahma, the God of Creation, took pity on them, and created Palakapaya, a sage who would be compassionate to elephants. This sage is said to have lived in Assam, and wandered the forests with elephants. He understood the ailments that affected them, and is presumed to have written an ayurvedic text on treatment of elephant disorders, as well as one on the capture and upkeep of elephants. According to Palakapaya, Airawata was the first elephant that was created, followed by seven males and eight females, comprising eight pairs or 'Ashta dig-gaja'.

By the 4th Century BC, elephants had replaced chariots as royal mounts, and were used in the army. In the epics, Ramayana and Mahabharata, which probably describe Indian society of 1000-700 BC, 'Chaturang Bal' (four-armed forces consisting of chariots, elephants, cavalry, and infantry) is a standard description of a large army.

Chandragupta Maurya (321-296 BC) had 9000 elephants in his army, while the other rulers of the Indian subcontinent, collectively, had only around 5000 elephants. During the reign of his grandson, Ashoka (268-231 BC), the elephant became a symbol of both, himself, and Buddhism.

The importance of elephants in historic times is apparent in Kautilya's 'Arthashastra' (321-300 BC), the science of Statecraft or Government, which refers to an overseer of elephants, in charge of training elephants. The 'Arthashastra' recommends the creation of elephant sanctuaries on the periphery of kingdoms, to be patrolled by guards. Capital punishment awaited anyone killing an elephant within the sanctuary. The 'Arthashastra' also specified that calves, small-tusked or tuskless males, females with young and suckling calves should not be captured.

Tamil literature of the Sangam period (1st to 3rd

Century AD) includes the poetical lexicon, 'Nigandu', which lists 44 names for the elephant, with four names specially for elephant calves, indicating the integral part that the elephant played in people's lives. Kalidasa (400 AD), the great poet of the Gupta Empire, made repeated mention of the elephant in his plays and poems.

The entrance to King Harshavardhana's bastion in northern India (606-647 AD), is described in Bana's Harsha-Charita as, "dark with the congregation of elephants; some for tying up with silk ropes; some for carrying trumpets; some freshly captured; some received as revenue; ... some borrowed for elephant fights and games; some as gifts to be sent with ambassadors."

The continuing role of elephants in people's lives is evident in the impressive rock carvings of the Pallavas (600-740 AD) and in the sculptures of the Hoysala temples (1110-1138 AD) in south



India, as also in the temples of Orissa.

The Mughal Period also saw the use of elephants in war. Sher Shah's army included 5000 war elephants. In the last Mughal-Pathan battle in eastern Bengal in 1612 AD also, elephants played a major role. In 1658-59, when Emperor Shah Jahan's sons fought for the throne, the princes were mounted on elephants. Towards the end of the battle, the heir apparent, Prince Dara moved on to a horse because his elephant had become the object of concentrated attack. The empty howdah led his soldiers to conclude that he had fallen, and they fled.

The court historian of Mughal Emperor Akbar (1556-1605 AD), Abu'l Fazl, meticulously recorded the elephant's role in the army, and described the elaborate elephant stables with 32,000 elephants. Akbar's son, Jahangir (1605-1627), another great connoisseur of elephants, had 130,000 elephants (the editors of Jahangir's memoirs, finding the figure too high to be credible, tend to attribute it to scribal error).

Improved weapons later during the British Raj in the 18th Century, reduced the importance of elephants as war animals, and pushed them back from the frontline. They were then used mainly as status symbols by the rich and powerful, and in the great hunts or 'shikar'. Elephants were put back into military service once again to protect the difficult hilly and marshy terrain of the north-east Indian border from the Japanese, who were sweeping across south-east Asia and Burma.

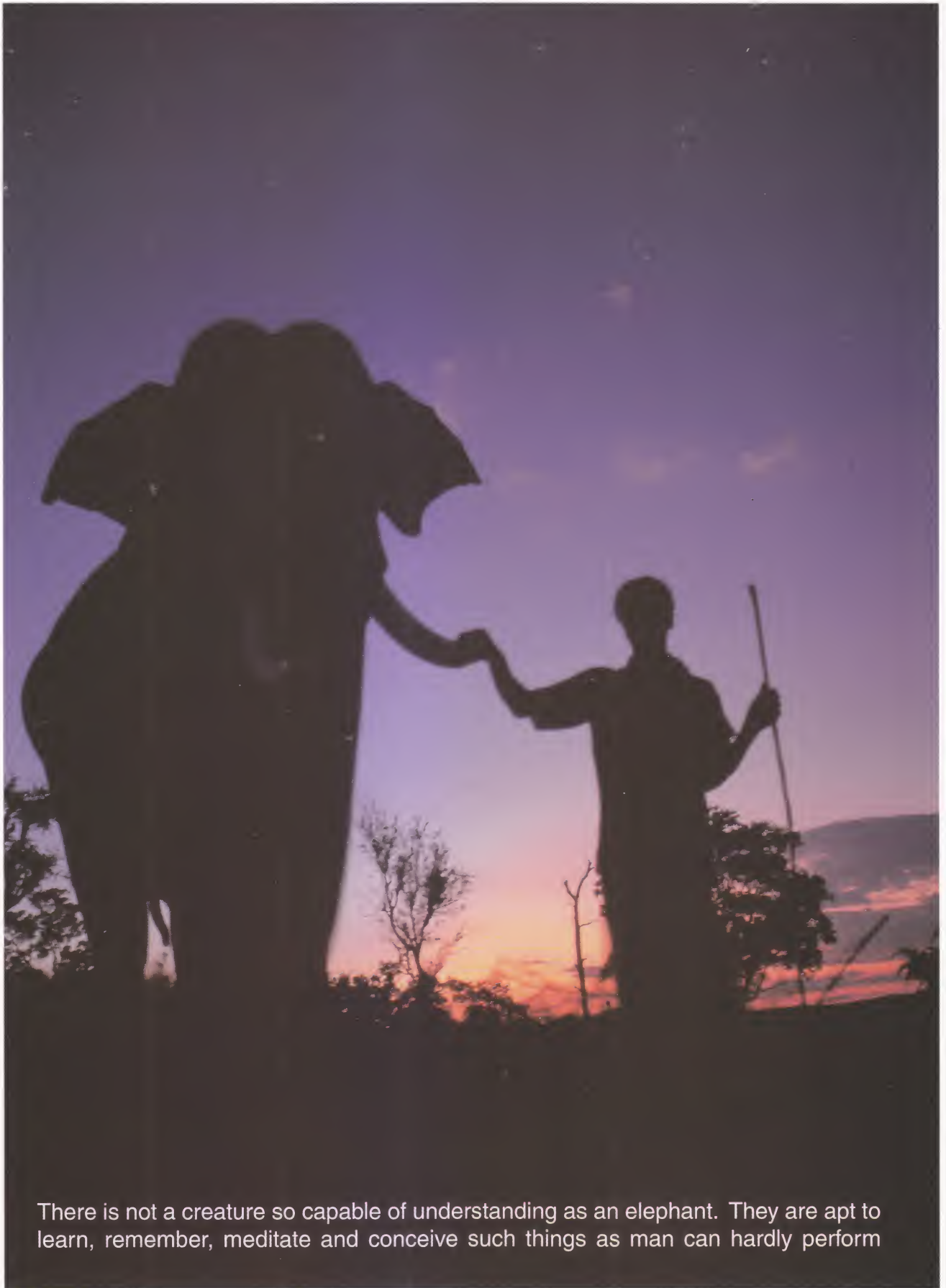
The reduced need for elephants today, is evident from the low numbers of elephants that are traded at the Sonapur Mela, the largest elephant fair in India, at the confluence of Gandak river with the Ganges. This fair used to attract thousands of elephants till the early 1960s. Presently, the major demand for captive elephants in India is from the logging industry, to transport felled trees from unmotorable forest areas. Elephants are also used by the forest departments of various states, to take tourists for trips through the forest. Hindu temples use them as status symbols, and for their various religious celebrations. □





Ivory carvings have been a symbol of aristocracy since time immemorial





There is not a creature so capable of understanding as an elephant. They are apt to learn, remember, meditate and conceive such things as man can hardly perform

Elephant-Man relationship

The Elephant-Man relationship has been extremely good in most parts of the country, due to unlimited human compassion and tolerance towards this enormous pachyderm and vice-versa. Even during the current times, when the depredation by elephants often results in great loss of property and human life, the local people, by and large, do not have any wrath against the marauders, often finding justification for the destruction of life and property, by blaming themselves for the sins and wrongdoings which may have brought forth the wrath of the Elephant-God. There are occasions when people attribute all good omens and even the onset of good monsoons to the presence of elephants in their neighbourhood.

Mahouts

For an animal of its size, the elephant is a remarkably gentle creature, and its dependability is indisputable. Man exploited this trait to the fullest, and successfully managed to domesticate this giant. Over the centuries, elephant trainers or 'mahouts' have mastered the art of handling and training elephants, and this skill is usually passed

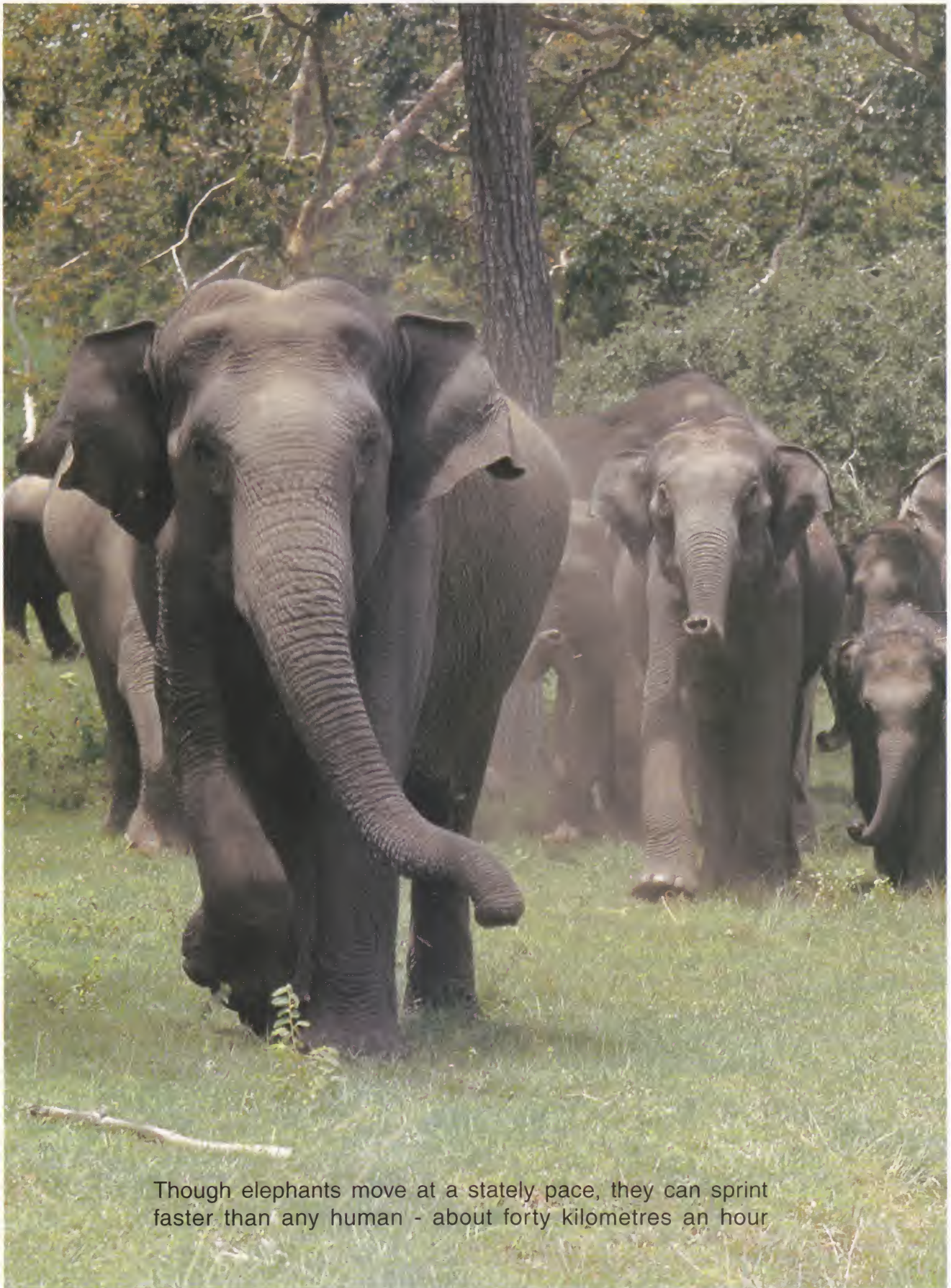
on from one generation to the next, as a family tradition. Elephants can display most astonishing aptitude in carrying out the assigned task with great precision. They gently push aside branches and creepers that come in their way while taking people through the forest on their back, and deftly pick up articles dropped by their riders.

Before the arrival of veterinarians, it was the task of the mahout to restore to health his ward. For this, it was imperative that he had a good knowledge of various aspects of the animal's health. The training and performance of an elephant are directly linked to its keeper's dedication, without which a mahout can never earn the elephant's trust and respect.

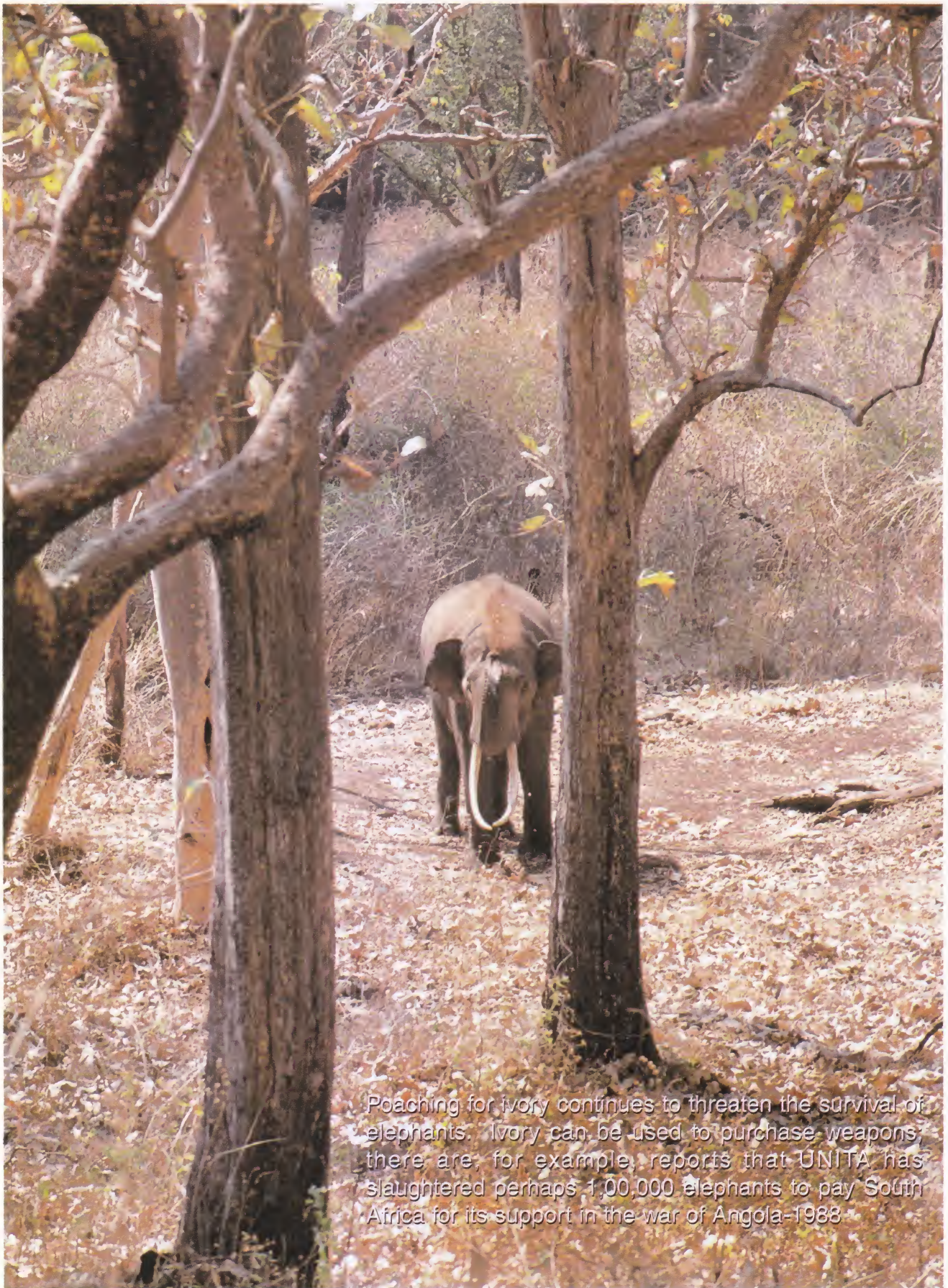
Most domestic elephants owned by the Government, have two persons each for their upkeep. The first is the mahout, who directly commands the elephant, and takes tourists and officers for visits and inspections on elephant back. The other is the grass cutter, whose responsibility it is to collect fodder for the animals, take them out to graze in the forest, and bathe them. A good mahout-elephant relationship can only be maintained through kindness and good care for the elephant, and the skill to handle the animal.



Good mahouts adeptly use their feet to guide and command elephants.
A well-coordinated mahout and elephant pair can perform incredible feats.



Though elephants move at a stately pace, they can sprint faster than any human - about forty kilometres an hour



Poaching for ivory continues to threaten the survival of elephants. Ivory can be used to purchase weapons; there are, for example, reports that UNITA has slaughtered perhaps 1,00,000 elephants to pay South Africa for its support in the war of Angola-1988.



Past And Present Distribution

In the past, the Asian elephant ranged from the Tigris and Euphrates valleys in present-day Syria and Iraq, to south-east China and down to Sumatra in the south. Today, it is found only in disjunct populations in India, Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar, China, Thailand, Laos, Cambodia, Vietnam, Malaysia and Indonesia. Of the estimated 45,000-50,000 Asian elephants remaining, approximately half are in India. Even within India, elephants have become extinct in the states of Punjab, Rajasthan, Gujarat, Madhya Pradesh and Maharashtra.

The past and the present distribution of the elephant in India is an indicator of the drastic deterioration of elephant habitat, which has led to the progressive decline and reduction of the elephant population in the country.

In historical times, the elephant inhabited all but the most arid areas in the Indian subcontinent, having been recorded even from the dry tracts of Punjab and Saurashtra in the 4th Century BC. Kautilya's 'Arthashastra' mentions eight 'vanas' or

abodes of elephants. Subsequently, the loss of habitat and capture of elephants by kings for their armies led to the depletion of elephant populations.

Memoirs and writings of the Moghul Era (16th Century AD) present precise information on the distribution of the elephants in medieval India. Emperor Babur (1526-1530) notes in his memoirs that elephants inhabited Kalpi (present-day south Uttar Pradesh), and as you advanced towards the east, the elephants increased in number. Abu'l Fazl's 'Ain-i-Akbari', a chronicle of the times of Akbar, records elephants in many parts of central India, including Narwar, Chanderi Satwar, Bijagarh, Raisen and Panna (Madhya Pradesh). Jahangir describes an elephant hunt in Dohad in the Panchmahal hills in Gujarat. Jerdon (1874) describes the distribution of elephants as along the Himalayan foothills from Bhutan westwards to Dehradun, in central India from Midnapore (West Bengal) to Mandla (Madhya Pradesh), and southwards to the south of the Godavari river.

By the end of the 19th Century, four distinct elephant regions remained: southern India, central India, a narrow belt along the north-western

Himalayan foothills, and north-east India. Each of these regions had further fragmented populations. In the south, certain hills of the Eastern Ghats, such as the Sheveroys and Kollimalai, still held some elephant herds. The Imperial Gazetteer of India (1907) refers to many isolated herds of elephants in northern and central India, such as Nahan and Ambala (Punjab), Udaipur (Rajasthan), Bilaspur (Madhya Pradesh) and Parkal (Andhra Pradesh), all of which have disappeared since then. The status of wild elephants in the past remains unclear, but Jardin (1836) puts the number of elephants in captivity during the 19th Century at 40,000.

The Asian Elephant Specialist Group of the IUCN describes the current distribution of elephants in India in four disjointed populations:

- (i) A north Indian population in the forest divisions of Dehradun, Bijnor and Nainital, in the states of Uttar Pradesh and Uttaranchal;
- (ii) Several sub-populations in south India, discontinuously distributed in the Western Ghats, as well as in parts of the Eastern Ghats, in the states of Karnataka, Kerala and Tamil Nadu (to this can be added Andhra Pradesh, where some

- elephants have moved recently from Tamil Nadu).
- (iii) An eastern Indian population, discontinuously distributed in south Bihar, south-western Bengal and Orissa;
- (iv) A north-eastern Indian population, discontinuously distributed in north Bengal, Arunachal Pradesh, Meghalaya, Mizoram, Nagaland and Tripura, and some transients in Manipur from neighbouring Myanmar. The ranges of some of these sub-populations extend into Myanmar and Bangladesh.

Apart from these four populations, there exists a small population in the Andaman and Nicobar Islands.

The estimated elephant population according to the Forest Department census figures for the year 2001, is as follows (see also Table 1):

North India - 1000-1984
 South India - 14869
 East India - 2480
 North-east India - 9296-9326
 Andaman and Nicobar Islands - 40-70
TOTAL - 27685-28729





It might not be merely coincidence that some of the tallest elephants shot by the British in the 1920s had only a single tusk

Ecology

Elephants are extreme generalists and have adapted to a wide range of vegetation types, ranging from dry thorn forests to wet evergreen forests. They are able to do this, since they are able to live on a wide variety of food plants. While they are dependent on grass for the bulk of their diet in the deciduous forests that are dominated by grass, they can live almost entirely off browse (woody plants) and fruits in evergreen forest where there is no grass.

Their digestion is very poor, and hence they must eat a lot to meet their nutritional requirements. Adults can consume between 100 and 150 kg of fodder a day, and may drink up to 150 litres of water in a day. In order to acquire this large amount of food, they spend a large part of their day eating, and can be found feeding for 16 to 20 hours a day. Despite this need to feed for extended periods and being generalists, they are still selective about what they eat. When feeding on browse, they mainly

feed on bark. When feeding on grass, they eat the entire grass clump when it is green and soft, at the beginning of the wet season. As the grass grows, they shift to eating the green leaves and discarding the roots. When the grass begins to dry, the elephants discard the grass blades, and eat only the lower stem and roots that still have moisture and nutrients in them. It is very interesting to watch them feed in this way, as they uproot the entire grass tussock, then carefully remove the dirt from the roots by striking it against the forefoot and then checking the roots in the mouth to see if all the dirt has been removed. Once they are satisfied that the roots are okay for eating, they will bite off and eat the lower stem and root, and toss the upper grass blades away.

It is very important for elephants to clean the grass roots before eating, as soil will hasten the wear of their teeth. Elephants have only six sets of molars and these erupt one after the other in a linear fashion. The molars descend into the jaw from the rear and gradually slide forward. As one molar gets worn out, it is gradually pushed to the front by the



molar behind it, till it falls off as a small worn-out bit from the front tip of the jaw. Once the sixth set is worn out, the elephant can no longer chew its food and therefore no longer digest it well, and hence will literally die of starvation. The rate of wear depends on the food they eat and it makes a lot of sense not to eat soil along with grass, as that would hasten teeth wear.

While the bulk of time is spent on feeding, water is also a very important and critical resource for elephants. In addition to the need for drinking, elephants also need water to cool themselves. Elephants, like pigs, do not have sweat glands and cannot cool themselves by sweating. In the absence of sweat glands, thermoregulation is a problem for elephants, especially in dry and hot areas. They overcome this problem in a unique way by having large ears with a rich supply of blood vessels close to the surface. These ears act like radiators and hot blood coming into the ears is cooled by several degrees centigrade and sent back into the body. They bathe in water or wallow

in mud to cool themselves whenever they get an opportunity. They also toss dust and mud onto their backs so that their backs are not exposed to direct sunlight.

Wallowing in mud also helps to dislodge skin parasites that are difficult to scratch out. Elephants usually scratch themselves against trees or other objects immediately after wallowing and also after the mud dries, in order to dislodge the parasites that get embedded in the mud. Mud and dust tossed on the back also helps to shield against biting insects. To drive biting insects off their bodies, elephants also use small saplings or branches as fly swats! This is usually seen when elephants are resting in the hot hours of the day.

Elephants rest twice in a day, once during the hot hours of the day and the other just before dawn. Like horses, they can sleep while standing but they also lie down and sleep. Calves always lie down and rest.

Bamboos are always a favourite food of elephants, and seem to be specially attractive when they have flowered





While adult elephants can also sleep while standing, calves always lie down to sleep

Social Organisation

The social organisation of elephants is interesting, with males and females having different social organisation. Males are solitary, while females live in herds. The female society is matriarchal, and the oldest female is the leader of the family. Quite like the social organisation we have in some parts of south India. The earlier stories of herd bull are not true, as a bull does not lead a herd. Female societies are composed of independent units called clans. Clans are composed of bond groups and family units. A family unit is the smallest and most stable unit in the elephant society, and is composed of an adult female and its dependent offspring. The size of the family unit will vary depending on the number of dependent offspring. It is not often that family units operate on their own; being very social animals, they tend to associate with other family units. Such associations could be between the family units of a mother and her adult daughters, between several

adult sisters and even between cousins! While all family units within a clan will associate with each other at some point in time, some family units tend to be closer with each other and associate with each other more often than they do with other members of the clan. Just like we have closer relations with some members of our families than we do with others. Such associations are called bond groups and may consist of two or more family units. It is believed that all members of a clan are related.

While members of a clan may not be together all the time and may be spread out at various distances from each other, they all show the same general movement pattern. Clans represent the largest cohesive unit within an elephant population. While clan members associate with each other regularly, they do not normally mix or associate with members of other clans. Sizes of clans vary,



Bond groups interacting at a salt-lick



Large aggregations of family units are often seen at waterholes

and clans consisting of over 200 elephants have been reported in Africa; in India, clans consisting of over 50 elephants have been recorded. Very rarely do all members of a clan aggregate as a single herd. The term 'herd' is a very loosely used term and represents just a group of elephants, anything from a single family unit to a bond group, or even the entire clan, depending on the composition of the group of elephants seen.

Males live largely solitary lives, and do not really form strong bonds or associations with other males or female social units. Being social animals, males will however associate temporarily with any other elephants (males or females) that they may encounter during their normal activities. They also associate for short periods of time with female herds for breeding.

Elephants begin to learn about social behaviour at a very young age. In good conditions, females give birth every 4 to 5 years, so when one calf is four or five years old, the next calf is born. If the older offspring is a female, she normally accepts the newborn and will help in looking after the younger sibling. This behaviour becomes very pronounced as the female calf grows older, when she will put a lot of her time in helping the mother look after the young. This behaviour not only prepares the young female to become a mother later in life, but also allows the mother to gain extra time for feeding and resting. A task very similar to baby sitting, which is beneficial to both the mother and the older daughter. Females who indulge in this behaviour are called Aunts. Sometimes even adults may help in looking after others' calves, and sub-adults may look after calves that are not their own siblings. Studies in Africa have shown that calf survival is increased when there are aunts helping the mother to look after them. This behaviour is therefore very important for elephants, and it plays a big role in members of a clan bonding together.

Living in close-knit social units also ensures that the whole group responds to any threat. For elephants, the main threat comes from tigers, and even that is almost entirely directed towards calves. Large sub-adult and adult elephants do not face any real danger, as they are too large for tigers to tackle. Although there are a few stray

cases of adults being attacked by tigers, it is usually calves and juveniles that are likely to be attacked by tigers. Whenever there is any danger, all the members of the herd will respond and gather together to face the danger, and usually an adult or large sub-adult will charge at the source of danger, and it is often joined in the attack by the entire herd. Such a charge from a single large elephant or the herd is usually enough to dissuade the tiger from its ideas of preying on any calf or juvenile in the group. Other than tigers, man is the only other threat to elephants.

The social development of male calves is quite different from that of females. From a very young age, they begin to play with other calves, and tend to wander away from their mothers to play. Initially, they stay and play close to their mother, but by the age of two or three years, they move about within the bond group, playing with other males. They obviously need protection and milk, so they do return to their mother every now and then. With the arrival of a new sibling, their first reaction is to the loss of milk from the mother. A female in good habitat would lactate almost throughout her reproductive life that could stretch for 40 years! So when a new calf is born and the older one is a male, it will still want to suckle even though it is over four years old and can do without milk. The mother normally does not allow this, as it would be harmful to the newborn calf, very rarely do females allow two calves to suckle. The male calf



resents this and as it no longer gets milk from the mother, it becomes more independent of her. Female calves do not do this, and stay close to the mother till they are adults and have calves of their own. Even then they may stay with the mother and remain a part of the mother's bond group.

By the time males are ten years old, they move between bond groups within the clan. During this time, they are gradually becoming large enough to avoid predation by tigers, and therefore the need for protection from the clan. It is usually between the ages of 10 and 15 that they begin to move about independent of the natal clan, and gradually associate with other clans, and adult and sub-adult males in the area. They establish new home ranges for themselves that may overlap the natal home range, or may be far away from it. This process of establishing a home range independent of the natal home range is known as dispersal, and helps to avoid inbreeding.

Juvenile and sub-adult males resort to play much more than young females. Play is usually in the

form of play-fighting, which is very important for the males in later life. Play-fighting helps males to gauge the strength of other males without getting into serious conflict that could be dangerous to both combatants. This helps males establish hierarchies, where each male in an area is aware of the strength of other males. Therefore, when situations arise where dominance needs to be established, it can be done without getting into serious conflict, since the males already know each other's strength. Serious fights do take place at times, and often result in grievous injuries and even death of one or both the combatants.

Home Ranges

Both, clans and solitary males, have specific home ranges within which they live their entire lives if undisturbed, and if habitat conditions remain suitable. As resources (food, water and shelter) are not uniformly distributed over the forest, elephants need to have good knowledge of where the resources are in order to survive. Such information cannot be gathered and used if from





elephants keep moving randomly over the entire forest area. Over time, clans search, find and remember what resources are found where, and they then repeatedly use these resources. Clans therefore develop an intimate knowledge about resource availability within a fixed area that will sustain them through different seasons and over the years. Their movements therefore get confined to the area which they have knowledge about, and which contains all the resources they require for survival. This area is known as the home range. Within home ranges, resource availability varies with season, and clans use those parts of their home range that provide the best resources in any given season. The areas used in different seasons are known as seasonal ranges. Clans normally confine themselves to their home ranges and rarely venture outside. They will abandon their home range only under extremely stressful situations like severe drought, severe poaching, habitat degradation or fragmentation.

As elephants live in matriarchal societies, the knowledge gained by one adult female is passed on to her daughters and grand-daughters, as she leads them to the different resources needed in different seasons. This information is available to the entire clan, and is passed on from generation

to generation. The need for and the usefulness of the matriarchal society are evident in this behaviour. The absence of such a social organisation would result in elephants becoming less successful in survival, as important information of resource availability would not be passed on from generation to generation. Home ranges of different clans may overlap, but their strategy of habitat use will vary.

Males too have their own independent home ranges, which might overlap with those of other males and of clans. As they are solitary, their resource requirements are less than those of clans, and hence they can take the chance of establishing new ranges.

Home range sizes vary with habitat type and quality. As can be expected, in habitats that are poor in resources, home ranges tend to be big, and in better habitats they are smaller. In Africa, home ranges as small as 35 km² and as large as 4000-5000 km² have been recorded. In Asia, there have been fewer studies, but home range sizes from 150 to over 600 km² have been recorded. In many cases, very small home ranges, both in Asia and Africa, are a result of habitat loss and compression of home ranges due to human activities and impact on the elephant's habitat.



Reproductive behaviour

Elephants breed throughout the year, with a minor peak in the wet season. Females are capable of breeding from the age of 11, but normally the age at first calving is between 15 and 20 years of age. Females are reproductively active for nearly 40 years, and can have calves even when they are in their 50s. The number of calves a single female can produce varies with habitat quality. In good habitats, inter-calving intervals can be as short as 4 years, and in bad areas, they can extend up to 9 years or more. In good areas, a female can have up to 10 calves in her lifetime. Usually only one calf is born after a gestation period of 18 to 22 months. In rare cases, twins have been recorded. Calves can weigh between 90 and 125 kg when born, and are usually 90 to 100 cm tall.

While females are reproductively active from a fairly young age, males may not be reproductively successful till they are in their 30s. In a normal population, competition among males for females would result in only the larger adults monopolizing

all the mating, and smaller adults in their 20s would have little chance of competing successfully against the larger males. While males can breed throughout the year, they are generally reproductively active only for a part of the year. As there is strong competition for mating, males build up their body condition before becoming reproductively active. They enter a phase known as 'musth', which sees change in the physiology and behaviour of the male. In adult males, it is a regular annual feature, and usually occurs during the same period for each bull. Under normal circumstances, males build up body condition and then enter musth. In musth, the blood testosterone level increases dramatically, and this in turn increases aggressive behaviour as well as sexual drive. Once this happens, males wander in search of oestrous females for mating. During musth, the temporal glands of the male swell up and exude a strong smelling fluid that acts as a signal to other males and females, indicating that the male is in musth. Musth males also dribble urine as they walk, and this urine too has a smell similar to the temporal gland, but the odour is much stronger. The urine too acts as signal to other elephants.



Tusker in *musth* approaching female

As they are in good body condition and are also very aggressive due to the increased testosterone, they are able to dominate other males that are not in musth, and may even be larger than them. This helps them to become reproductively more successful.

The external signs of musth, and the duration of musth vary with the age and size of the elephant. Usually, smaller bulls in their early 20s will not even exhibit external signs like temporal swelling and urine dribbling, but males in their late 20s and early 30s will show these signs. In males in their 30s, musth may last from 1 to 2 months, and gradually increases with age, and bulls in their late 40s and 50s can remain in musth for periods up to 6 months. During musth, the male devotes less time to feeding, and more to wandering in search of females. The constant urine dribbling causes a lot of stress, and this results in loss of body condition. After musth, males usually confine their movements to a small part of their home range, and concentrate on rebuilding their body condition before the onset of the next musth period.

Communication

Elephants have large heads, and their ears are relatively far apart. As the distance between the ears increases, the ability to hear low frequency sounds also increases, enabling elephants to hear low frequency sound (infrasound) that is not audible to human ears. Their range of hearing and vocalization extends from infrasound to sound that is audible to human ears. Infrasound also carries over long distances, and this allows elephants to communicate over long distances. It also largely explains how clans with their various sub-units scattered over large areas, are still able to show coordinated movement. In addition, elephants are also very sensitive to smell, and use smell extensively for communication. Individual members of the clan (or family unit) are recognized by smell, and it is also used to identify other clans, or males that a clan may encounter within its range. □





Elephants in Karnataka

Within India, Karnataka probably has the best and most secure elephant population. The most recent estimate (2001) puts the elephant population of Karnataka at over 6000 (Tables 1 and 2), the highest for any state in the country. Elephants are found along the Western Ghats and the Eastern Ghats that run through the state. They are present from Dandeli in the northern part of the Western Ghats to Bandipur National Park on the southern end of Karnataka's Western Ghats. Their numbers are very low in the northern part, and reach their highest numbers in Nagarhole and Bandipur National Parks. In the Eastern Ghats, they are found in the Biligiri Rangaswamy Temple (BRT) Wildlife Sanctuary and adjoining forests.

Detailed information on the presence of elephants in the various protected areas is available in the Karnataka Forest Department's publication, "A Walk on the Wild Side: An Information Guide to National Parks and Wildlife Sanctuaries of Karnataka".

The population in southern Karnataka is connected with elephant populations in Kerala and Tamil Nadu. Along the Western Ghats, where the borders of these three states meet, the Nilgiri Biosphere Reserve has been established. Both Nagarhole and Bandipur National Parks are a part of this biosphere reserve, which covers an

area of over 5000 km² and is part of a large forest tract that covers over 13,000 km² (Table 3). This large tract of forest supports about 6300 elephants. The large size of the habitat and population, combined with the extensive and large network of protected areas covering a significant part of the elephant population and habitat, make this area the best area for the conservation of the Asian elephants in the world.

Karnataka is also known for the 'Khedda' method of capturing wild elephants. This involved rounding up and driving the elephants into a huge stockade. It was a massive operation, involving thousands of men and a large number of 'Koonki' elephants, which are trained in the capture of wild elephants. Usually, whole herds would be caught in a single Khedda. Between 1890 and 1971, 1536 elephants were captured along the Kabini River in Nagarhole National Park.

The famous Khedda operations for capturing wild elephants date back to the 18th Century. The word 'Khedda' is derived from the pit (Khadda) formed around the enclosure. Elephants were attracted to the stockades where they were roped with the help of koonki elephants. The Prince of Wales witnessed Khedda operations at Kakanakote in 1905-06, which was the 14th Khedda in the State of Mysore. The last Khedda operation took place in 1971. After the construction of the Kabini reservoir, the entire area suitable for Khedda operation has been submerged. □

Conservation Issues

Issues relating to the conservation of elephants can be divided into two distinct categories:

- Activities that affect elephants directly, such as hunting and capture;
- Human activities and development programmes, leading either to the loss of elephant habitat or its qualitative degradation.

Hunting/Poaching

Of the activities falling in the first category, hunting of elephant for meat is not of much consequence in India, due to the taboo attached to the eating of elephant meat in most parts of the country. Capture of elephants for commercial purposes also stands banned after the 1986 amendment of the Wildlife (Protection) Act. A few cases of illegal sale of elephants captured from the wild, in the garb of captive-bred elephants, cannot be ruled out; but this is not something that may pose an immediate or serious threat to the elephant population of the country. The activity that is of serious consequence, is the poaching of the male tuskers. An estimated 100 male elephants were killed in the country every year by ivory poachers between 1980 and 1986. This has seriously affected the male and female ratio in many areas. Poaching for males with tusks has depleted the male population in south India. Today, with sex ratios in some parts of the elephant range reduced to 1:90, and 1:20 or 25 even in moderately good areas, there are clear indications that poaching has had a very adverse impact on the population. At this stage, even the loss of one male is very serious.



A slain elephant, tusks removed

Elephant mortality cases recorded in Karnataka by the forest department between 1990 and 2001 are given in Table 4.

While poaching has depleted the male population, the female population has been increasing over several decades. This is leading to local overabundance of elephants, especially in protected areas. This can have an adverse impact on vegetation, and therefore on habitat quality, and also increase conflict with surrounding human populations. A study done in south India indicates that elephants (possibly in combination with forest fires) are having an adverse impact on their preferred food tree species. This problem is yet to be recognised, and its implications understood.

Habitat loss

The major conservation problem today remains the exploitation of the elephant habitat, leading to the qualitative degradation and fragmentation of the habitat. This problem is related to the increase in India's human population, from 252 million in 1911 to 843.93 million in 1991, and over 1 billion in 2001. Biotic pressures from such a large population have led to the loss of much of the village forests and private forests to the plough, irrespective of the suitability of the area for permanent agriculture, degradation of such lands into wastelands due to faulty agricultural practices, and absence of appropriate soil conservation measures. This has further increased the dependence of the local people and their cattle on the forests, and is ultimately leading to accelerated habitat and environmental degradation throughout the elephant ranges in the country.

The loss, degradation and fragmentation of the elephant habitat, which has reduced the elephant's range to less than 20% of its historical range, still continues. Considering that the habitat that remains is only a small fragment of what it was in size and quality, further loss would have very adverse impact on elephant populations.

Conversion of natural forest to commercial timber or pulpwood monoculture plantations of eucalyptus, wattle, teak and silver oak, has also affected the elephant habitat seriously. Dams and reservoirs have, on the one hand submerged



Wild elephants on the outskirts of Bangalore city

prime valley habitats of elephants, and on the other disrupted habitual migration patterns by fragmenting the habitat. Construction of roads and establishment of human settlements in flat areas and in the valleys, has also fragmented elephant habitats. Regeneration of elephant food species has been seriously affected by lopping, grazing and fire. In Meghalaya, Nagaland and Tripura, a subtle but greater threat to elephants is from the traditional slash-and-burn shifting agriculture, whereby extensive areas of elephant habitat are diverted into agriculture.

Human-elephant conflict

Elephants require large areas to forage. If their natural areas are large enough, their daily or seasonal migration does not bring them into contact with any cultivation. Once the elephant habitat is fragmented or reduced in size, the isolated elephant populations are hemmed in small patches of forests, surrounded by vast area

of agricultural crops. Elephants raid crops only when there is a significant loss or degradation of their home range.

Human killing by elephants is the outcome of the elephants' incursion into cultivation, and roughly half of these cases occur within human settlements. Even some of the killings by elephants within the forests have their origin in settlements, where elephants may be injured by bullets and later turn into rogues. Many are also accidental killings of people who get in the way unknowingly.

With habitat loss, degradation and fragmentation, there has been an increase in human-elephant conflict. With increasing human populations, and greater aspirations and awareness, there is increasingly and justifiably less tolerance to problems created by elephants. This is not only detrimental to elephants but to conservation in general. □



This radio-collared female elephant, Harini's home range covered areas in Karnataka's Bandipur Tiger Reserve and Tamil Nadu's Mudumalai Wildlife Sanctuary



Tuskers such as this one, have large home ranges, often overlapping with those of clans

Project Elephant

Conservation Strategy and Action Plan

STRATEGY

As already noted, the major cause of threat to elephant populations in India is degradation and fragmentation of the elephant habitat, as a result of which several populations have been hemmed in. Such isolated populations, which have no genetic connectivity with any other population, are susceptible to genetic degradation and are highly vulnerable. For any species, there is a critical size of population, below which it is more or less doomed to extinction within a certain time period. The goal of conservation, therefore, is to maintain the size of population at a level that safeguards it against extinction over a period of time.

The Task Force, appointed by the Government of India, recommended the following aims and objectives for Project Elephant:

1. To conserve and protect the viable elephant population of the country, and to ensure that this population remains healthy and viable within the ecosystem of which it is an integral part.
2. To conserve and protect the habitats of elephants, and to improve the deterioration of viability and integrity of these habitats wherever necessary.
3. To conserve and protect, and where necessary, to open up, existing traditional corridors linking the parts of the habitats being used by elephants for their migration.
4. To create conditions, including welfare measures, through ecodevelopment and mitigation of man-elephant conflicts, to nurture and restore the traditional compassion and tolerance of the people living in and around elephant habitats who are increasingly falling victim to elephant depredation.
5. To take concrete measures to protect the elephant from poaching and other threats.
6. To create a viable mechanism to ensure inter-state, regional, and national level coordination in protecting and conserving the elephant and its ranges.
7. To create infrastructure and facilities, including

manpower training, for conservation support activities, veterinary care, humane methods of tranquillising and translocation, etc.

8. To encourage, and create facilities for research related to the ecology of the elephant and also its veterinary aspects.
9. To improve the welfare of elephants in domestic use, including veterinary care, training of mahouts, humane treatment of elephants, etc.
10. To educate the public about the ecological significance of conserving elephants, and to revive the historical public reverence and compassion for elephants in general.
11. To devise strategies and programmes of providing alternative sources of sustenance to craftsmen and communities adversely affected due to the ban on the trade of ivory products.

Minimum viable area and habitat integrity

The minimum viable area for the conservation of elephant is related to the minimum viable population size, and to the carrying capacity of the habitat. The carrying capacity of a rainforest may be much lower than a dry deciduous forest. In a rainforest, the carrying capacity may be around one elephant per 20 km², whereas in a dry deciduous forest, it may be one elephant per 5 km². The ideal habitat, with a good mixture of grasslands, might be able to sustain one elephant per 2 km². The minimum viable area needed for long-term conservation of the elephant population would, therefore, be around 4000-5000 km². Contiguous area of such a large extent is hard to find, but keeping in view the large home and a need for seasonal movement from one habitat type to another, it would be essential to conserve as much area of the elephant habitat as possible. Migration corridors between adjoining habitats provide genetic continuity between populations living in adjoining habitats, and are of crucial importance for making habitats of reasonable size also viable.

ACTION PLAN

Management of elephant ranges and corridors between adjoining habitats

There can be no hard and fast rule about the design of corridors. The main thing is to ensure that elephants will use them and will not spill over into the adjacent human settlements. The viability of corridors naturally depends on the distances separating two populations. If the distances are relatively small, then the corridor need not be very broad. A corridor of about 1 km width could be sufficient to see the elephants through. The width would have to be much more if the distance between the two habitats is significantly more. A corridor need not be a very good habitat. It can be degraded vegetation or a monoculture that provides cover for the migrating elephants.

In cases of habitats that have been fragmented by various river valleys, canals, roads etc., a reasonably broad bridge can function as an effective corridor.

Preserving the integrity of elephant habitats should not be lost sight of while planning any new development project, and appropriate measures to keep the migration corridors for elephant intact must be taken. It is with this fact in view that the Asian Elephant Action Plan has recommended setting up of Managed Elephant Ranges of sufficient size and ecological diversity to accommodate viable elephant populations.

The Task Force appointed by the Government of India to finalise the strategy of conservation of elephant under the Project Elephant has identified some elephant ranges for such management, to be called Elephant Reserves (Table 3 and Appendix).

Management of elephant habitats

The areas required for conservation of elephants would be significantly large, but it would be neither desirable nor practical to attempt to eliminate human activities and ban forestry operations in

these areas altogether. In the words of an ecologist, Mr. Norman Myers, conservation in the developing countries has to sustain not only the spirit but also the stomachs. Any grandiose plan for conservation without making adequate provision for protecting human interest is doomed to failure. The conservation plans for the elephant will have to concentrate not only on restoring the fragmented and degraded home ranges of the elephant, but also on the improvement of the quality and security of the life of the human populations which share the elephant habitat and its resources. In view of the facts stated above, the concept of totally protected 'core areas', which have been used successfully for the conservation of the tiger, may not be useful for elephant conservation. Although there should be no effort to dilute the protection available in the protected areas forming part of the large elephant ranges, the main strategy for the management of elephant ranges would be to accommodate such human activities that are compatible to and consistent with elephant conservation, and still provide the local population their share in the forest usufructs. Sustained yield forestry, controlled livestock grazing, and slow rotation shifting cultivation, should not be viewed as activities necessarily harmful to elephant conservation.

The following guidelines have been recommended for managing the quality of the habitat and preserving the integrity of the areas:

1. Since most of the proposed Elephant Reserves fall in more than one state, inter-state cooperation programme has been recommended for eco-restoration of the habitats, by way of moderating the pressure of human demands, and allowing nature to heal the scars of over-exploitation, and eradication of weeds and other exotic plants, which do not form part of elephant food.
2. Steps to restore critical migration corridors.
3. Planting of indigenous species that are preferred by the elephants, wherever necessary.
4. Steps to augment and conserve water resources.
5. Creation of effective barriers to prevent elephants from straying into human habitations

and agricultural fields.

6. Expeditious payment for loss of life and property caused by elephants, and exploring the possibilities of adopting appropriate insurance schemes.
7. Efforts to reduce dependence of local communities on forest usufructs and finding alternative means of sustenance.
8. Efforts to change the cropping pattern through persuasive methods.
9. Programmes for improvement of livestock breeds, popularisation of alternative sources of energy, and stall-feeding of livestock.
10. Wherever villagers so desire, steps to translocate villages to safer places.

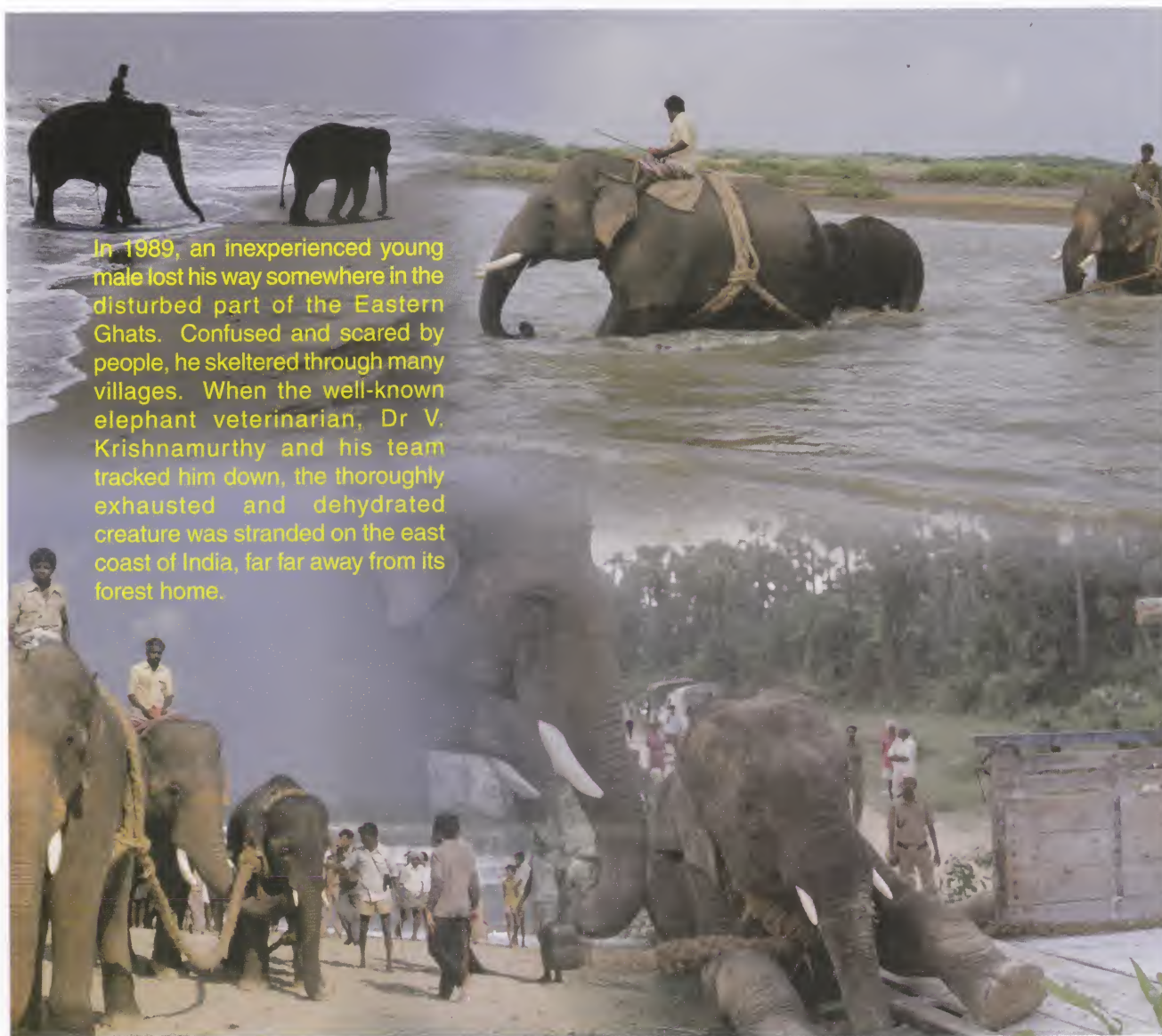
11. Strengthening of infrastructure for anti-poaching measures.

Measures to mitigate the problem of crop-raiding and human killings

Once of the major tasks before Project Elephant would be tackling the problem of elephant depredation.

To prevent elephants from straying into agricultural fields, live fences energised by solar cells and a 12 volt battery, have been used effectively in some areas. In south India, 2 m X 1-1.5 m trenches have been tried extensively. Karnataka authorities are trying now three-metre wide trenches.

An example of how badly elephants can be affected by human disturbance:



Sausage barriers' of boulders held together by wire-netting, rubble wall, and fences of iron girdles have also been tried in some of the areas. None of the barriers has been found to be totally fool-proof.

Crop damage can also be reduced by persuading the farmers to grow commercial crops that yield good economic returns but are not consumed by elephants, like oil seeds, etc.

Culling, capture and translocation of elephants

Notorious crop-raiding elephants, or small hemmed-in populations, which are in regular conflict with people, may have to be translocated or captured for domestication. The tradition of domesticating elephants in India would make it possible for such small herds to be captured rather than killed. However, there may be no alternative but to eliminate adult animals which have turned rogues and are dangerous to human lives. Selective removal of animals which are habitual killers will reduce depredation to a far greater extent than elimination of family herds. While selecting bulls for capture, due care should be taken to ensure that tuskers alone do not become targets for removal or elimination – 'makhnas' (tuskless bulls) should also be taken, to prevent imbalance in makhna-tusker ratio in a population.

Animal welfare

The strategy spelt out above, which involves some exploitation by domestication, must take into account the need for proper upkeep and care of the animals. The use of elephants for timber operations, patrolling the forest and in tourism will have to be carefully done so that the elephants are not subjected to undue stress.

Methods of capturing have to be humane and more emphasis has to be laid on training of right type of mahouts. Forest officers and the veterinarians have to be hand-picked and trained to ensure that no cruelty is inflicted on elephants.

Problem populations

Being convinced that efforts to protect every individual elephant is bound to dilute the efforts for conservation of elephants by alienating the local communities, the Task Force also identified problem populations, which are doing considerable damage to the life and property of the local people. It has been recommended that efforts to translocate such populations to viable elephant habitats should be taken up. Where these efforts do not mitigate the problem of depredation, such elephant herds must be captured and domesticated and put to effective use. The Task Force recommended setting up of two units for capture of elephants in the south West Bengal, Bihar and Orissa; two units for North Bengal and three units for Assam and Meghalaya.

Other important recommendations of the Task Force

The Task Force has recommended that appropriate monitoring and evaluation of the project is very crucial for ensuring that the investment being made into the project is bringing the desired results. The Committee for the monitoring and evaluation should include some anthropologists, in addition to wildlife conservationists.

Research:

For effective implementation of the project, regular collection of field data should be taken up. Help of the Wildlife Institute of India, Bombay Natural History Society and other related non-governmental organisations should be taken in this regard, besides posting research officers for each reserve. Small field laboratories having facilities for routine analysis of blood and stool should also be established.

Education and awareness campaign:

It is most important that the local people are educated about the tangible benefits of Project Elephant, and they be convinced that no undue restrictions are being imposed on them. The policy of providing employment to the local people in anti-poaching activities, fire control measures and

census operations, would help in developing a kinship between the reserve authorities and the local people. Educated youth should be involved in the extension programme.

Veterinary units:

The State Governments should set up veterinary units in the area of each reserve, so that they do not only help in capturing of elephants from the fringe areas, but also carry out immunisation of livestock against communicable diseases. Each veterinary unit should have a veterinarian and a stockman/compounder who are highly dedicated to their job, and have the aptitude to cooperating with the local people. Regular training programme should be organised for the staff posted in these units.

Training of mahouts and elephant managers:

Healthy mahout-elephant relationship and the feeling of compassion and love towards the elephant in this country has a long tradition and history. In recent years, there have been reports about the cruelties being inflicted upon elephants by mahouts. The old traditions of compassion and kindness to the elephants have to be restored, and regular training programmes for mahouts about handling the elephants in a more humane and affectionate manner have to be organised. Special training courses for elephant managers both within the Government and in private organisations should also be provided in the project.



An ecological study by BNHS has revealed hitherto unknown facts on movement, home range and crop-raiding behaviour of elephants



APPENDIX

ELEPHANT RESERVES IN INDIA

1. South West Bengal – Jharkhand – Orissa Elephant Reserve

The Reserve comprises of moist deciduous and semi evergreen forests in Orissa, Jharkhand and south West Bengal. The estimated elephant population of the area is 1560. The forest divisions and wildlife reserves covered by the reserve are:

- Orissa – Bonai forest division part, Sambalpur forest division part, Deogarh forest division, Keonjhar Karanja, Simlipal, Angul forest division, Ushakoti wildlife sanctuary, Khalasuni wildlife sanctuary, Badampahar.
- Jharkhand – Dalma wildlife sanctuary, Saranda forest division, Kolhan forest division, Porhat forest division, Dhalbhum forest division.
- South West Bengal – Mayurjharna wildlife sanctuary.

The total area of the reserve is 9350 km².

The main problems of management are large scale mining, replacement of natural sal forest with teak forests and cultivation. Construction of dams have also contributed in depleting elephant habitats. Large scale disturbances in the elephant habitat have resulted in long distance migration towards Raigarh and Sarguja districts in Madhya Pradesh, and Midnapur districts in West Bengal. The instances of man-elephant conflict have increased seriously during recent byears due to chasing of elephants from one place to another by the farmers.

2. Kameng – Sonitpur Elephant Reserve

The area of the reserve extends over a 120 km long stretch of semi-evergreen forest in Arunachal Pradesh and Assam. The estimated area of the reserve is about 4300 km², covering the following areas with an estimated population of about 1580 elephants:

- Kheolong forest division, Bandardeva forest division, Darang East and West forest divisions, part of North Kamrup forest division.

The main problem of management in the reserve

is continued denudation of forests in Bandardeva division in Arunachal Pradesh, and all the areas in Assam. Settlements, leading to fragmentation of elephant habitat in Bandardeva forest division has also affected the elephant habitat in the reserve. The situation has been further deteriorated due to growing insurgency. Action will have to be taken on priority basis to stop the degradation of forests, and programmes for eco-restoration and establishing crucial elephant corridors will also have to be taken up.

3. Dibru – Deomali Elephant Reserve

The elephant reserve extends over an area of 4400 km², covering the following areas:

- Arunachal Pradesh – Kamlang wildlife sanctuary, Turung reserve forest, Mamobhom reserve forest, Devmali Kanubari area (Khonsa forest division), Namsai forest division.
- Assam – Dibru-Saikhowa wildlife sanctuary, Digboi forest division, Dumduma forest division and Jaypore range of Dibrugarh forest division.

The estimated elephant population of the reserve is about 500. Poaching by local people, including capture of live animals, poses a serious threat to elephant population in the reserve. Fragmentation of the habitat and growing tendency of encroachments have affected the reserve over the years. Degradation of the habitat by overuse is also a serious problem.

4. Kaziranga – Karbi Anglong – Intanki Elephant Reserve

The elephant reserve extends over an area of 4900 km², and the estimated elephant population is 1800 elephants. The areas covered under the reserve are:

- Assam – Kaziranga National Park, Karbi Anglong East and West forest divisions, North Cachar hills forest division (south upto Mufa), Golaghat forest division.
- Nagaland – Intanki Wildlife Sanctuary.

The problems threatening the elephant reserve are insurgency, illegal extraction of timber, encroachment and poaching. The large scale human dependence on the habitat have led to elephants straying out into agricultural fields and depredating agricultural crops.

The proposed action plan includes restoration of 4 migratory corridors between Kaziranga National Park and Karbi Anglong forests. Effective control on poaching and wood cutting should be implemented. Enlarging the Kaziranga National Park and creation of Mikhir Wildlife Sanctuary should be taken up on a priority basis, to provide further protection to elephants and facilitate their seasonal migration.

5. Eastern Dooars Elephant Reserve

The elephant population in this reserve is about 800. The State Governments of Assam and West Bengal are interested to create this elephant reserve mainly to provide protection to rich biodiversity found in this area. The total area of the reserve is about 3800 km². The areas under this reserve include the plains along the Himalayan foothills, Manas in Assam, and Buxa-Jaldapara in West Bengal.

6. Balphakram Elephant Reserve

Balphakram National Park and adjoining areas are the only elephant habitat in Meghalaya, which can provide effective protection and long-term safety to the elephant population. Areas covered by the reserve are Balphakram National Park, Dambu Sangsak - Darugia Rongangiri reserve forest, including the proposed extension of the park, Bagmara and Cego wildlife sanctuaries, and Rewok reserve forest.

The estimated area of the reserve is about 2900 km². Of this, although about 55% is under vegetation, only 7% is under primary forest. The estimated elephant population is about 800.

The main management problems are insurgency, poaching from the Bangladesh side, shifting cultivation, and cultivation of cash crops by the shifting cultivators. The proposed action plan includes extension of Balphakram area to about 1500 km², protection from Bangladeshi migrants, capture of excess elephants, and activities for ecodevelopment and restoration. Expeditious payment for crop damage and human deaths is also very essential.

7. Nilgiris – Eastern Ghats Elephant Reserve

This is probably the largest reserve for elephants. It covers an area of 13,000 km², spread over the

states of Karnataka, Tamil Nadu, Kerala and Andhra Pradesh. An estimated 6300 elephants occur in this reserve. The forest divisions included in the reserve are :

- Karnataka – Hunsur, Nagarahole National Park, Mysore, Bandipur Tiger Reserve, Chamaraajanagar, Kollegal, Mandya (part) Bangalore (area = about 5000 km²)
- Tamil Nadu – Mudumalai Wildlife Sanctuary, Gudalur (part), Nilgiris North, Satyamangalam, Erode, Dharmapuri, Hosur (area = about 5000 km²)
- Kerala – Wyanad Sanctuary and adjoining areas such as Alattur Reserve Forest, Tirunelli, Judrakote, Hilledale, Trisshaleri, Harikara Shola, etc. (area = about 1000 km²)
- Andhra Pradesh – Chittoor District (area = about 2000 km²)

The vegetation in this reserve ranges from moist deciduous forest through dry deciduous forest to dry thorn forest. There are also plantations, mainly of teak and eucalyptus, in many divisions. There are also numerous human settlements in most of the divisions excepting for Nagarahole and Bandipur.

The major conservation problems include habitat degradation and fragmentation due to human settlements in places such as Hosur, Dharmapuri, Erode, Satyamangalam, Nilgiris North, Wyanad, Bangalore and Kollegal. Elephant-human conflict in the form of crop depredation and human killing is also common in these areas. Poaching of tusked was a serious problem in the past, but has reduced in recent years.

Strategies for conservation should include :

- a. Habitat improvement through fire conservation and plantation of suitable species.
- b. Securing critical migration corridors such as Masinagudi-Singara corridor in Mudumalai, and Wyanad-Brahmagiri corridor in Kerala.
- c. Trenching and/or electric fencing.
- d. Compensation for crop damage and human deaths.
- e. Ecodevelopment in areas outside wildlife protected areas.
- f. Strengthening anti-poaching infrastructure.

8. Nilambur – Silent Valley – Coimbatore Elephant Reserve

This reserve, lying mainly to the south of the Nilgiris and north of the Palghat gap, is estimated to have a population of 950 elephants spread over 2400 km², in the states of Kerala and Tamil Nadu.

The forest divisions include :

- Kerala – Nilambur (including New Amarambalam, Karimpuzha and Nilambur Vested Forest), Palghat and Kozhikode (including Silent Valley National Park, Attapadi Reserve Forest, Muthukulam, Kallady upto Walayar, ex-Manjeri Kovilakam, Nedunjehi) (area about 1600 km²)
- Tamil Nadu – Nilgiris South (part including Mukurthi Wildlife Sanctuary), Coimbatore (area = about 800 km²)

The vegetation includes large stretches of evergreen forests in Nilambur, New Amarambalam, Silent Valley and Attapadi, montane shola-grasslands in Nilgiri South and evergreen and deciduous forests in Coimbatore. Plantation forests are seen in areas such as Nilambur, Attapadi plateau and Coimbatore, which have numerous human settlements.

Conservation problems include encroachment of evergreen forests, degradation of vegetation due to fire and human settlements, and habitat fragmentation (in Attapadi). Conservation strategies include :

- a. Protection of evergreen forests from degradation by fire control, safeguarding from over-exploitation, and moratorium on monoculture plantations.
- b. Eco-restoration through fodder plantations in Attapadi and parts of Coimbatore.
- c. Mitigating elephant-human conflict.
- d. Securing of corridors in the Attapadi-Coimbatore region.

9. Anaimalai – Parambikulam Elephant Reserve

This reserve occurs to the south of the Palghat gap, in the states of Tamil Nadu and Kerala. The total population of elephants is estimated at 1600, spread over an area of about 5700 km². The forest divisions include:

- Kerala – Parambikulam Wildlife Sanctuary, Chimmomy Wildlife Sanctuary, Nenmara, Munnar (part), Malayattoor (part), Chalkudy (part) (area about 2100 km²)
- Tamil Nadu - Anaimalais (including Indira Gandhi National Park) (area = 900 km²)

The vegetation is diverse, from wet evergreen forest to montane shola-grasslands, moist and dry deciduous forest, and thorn forests. There are extensive teak plantations in Parambikulam. Numerous dams and canals of the Parambikulam-Aliyar project are seen. There are also coffee estates at the higher altitudes in the Munnar-Valparai region.



Conservation problems include habitat fragmentation by the network of reservoirs and canals (elephants have fallen several times into these canals), degradation of moist forests due to fire, and poaching of tuskers.

Conservation strategies include:

- a. Securing safe corridors for the migration of elephants.
- b. Habitat improvement through fire control and plantation of suitable species.
- c. Strengthening of anti-poaching infrastructure.

10. Periyar – Madurai Elephant Reserve

This reserve is spread over an area of about 3300 km², in the states of Kerala and Tamil Nadu. The estimated population of elephants is about 1500.

The forest divisions include:

- Kerala – Periyar Tiger Reserve, Idukki Wildlife Sanctuary, Chinnar Wildlife Sanctuary, Ranni (part), Kottayam (part), Konni (part), Achenkoil (part) and adjoining areas (area about 2000 km²)
- Tamil Nadu – Madurai South (including Srivilliputhur) (area = about 1000 km²)

The vegetation includes evergreen forest, moist deciduous forest and dry deciduous forest. The Periyar Reservoir is the focus of the elephant population here. There are numerous human settlements and plantations on the Kerala side.

Conservation problems include fragmentation of habitat, elephant-human conflict, poaching of tuskers, and illegal cultivation of *ganja* inside the forest.

Conservation strategies include:

- a. Identification and securing of crucial corridors for elephant movement throughout the Reserve.
- b. Strengthening of anti-poaching infrastructure.
- c. Eviction of illegal cultivators.
- d. Mitigating elephant-human conflict.
- e. Eco-development programme for improving quality of life for people.

11. Rajaji – Corbett Elephant Reserve

The area which supports the only population of elephants in Uttaranchal, extends through Shivaliks and Terai Bhabar forest track along the foothills of the Himalaya, from river Yamuna in the west to river Ramganga in the east. The total area of the reserve is about 3000 km², and the elephant population is estimated to be 750.

The areas included in the reserve are Dehradun forest division, Shivalik forest division, Rajaji National Park, Bijnor plantation division, Lansdowne forest division, Kalagarh forest division, Ramnagar forest division, Corbett National Park and Haldwani forest division. The track is covered with sal forest, mixed with miscellaneous species and strewn with rivers and streams, which make it a suitable elephant habitat.

The main management problems are division of land for non-forestry purposes, leading to disruption of migration corridors, over-grazing and lopping of trees by the livestock held by local people and *gujjars*, and lately poaching. Large-scale monoculture plantations and construction of reservoirs have reduced the extent of habitat considerably.

Conservation strategies include:

- a. Restoration of migration corridors.
- b. Control of grazing.
- c. Eco-restoration programme and relocation of the population inside crucial elephant habitat
- d. Payment of compensation to local people for crop damage.





Each elephant population has a cultural knowledge of its environment, which is passed on from generation to generation.

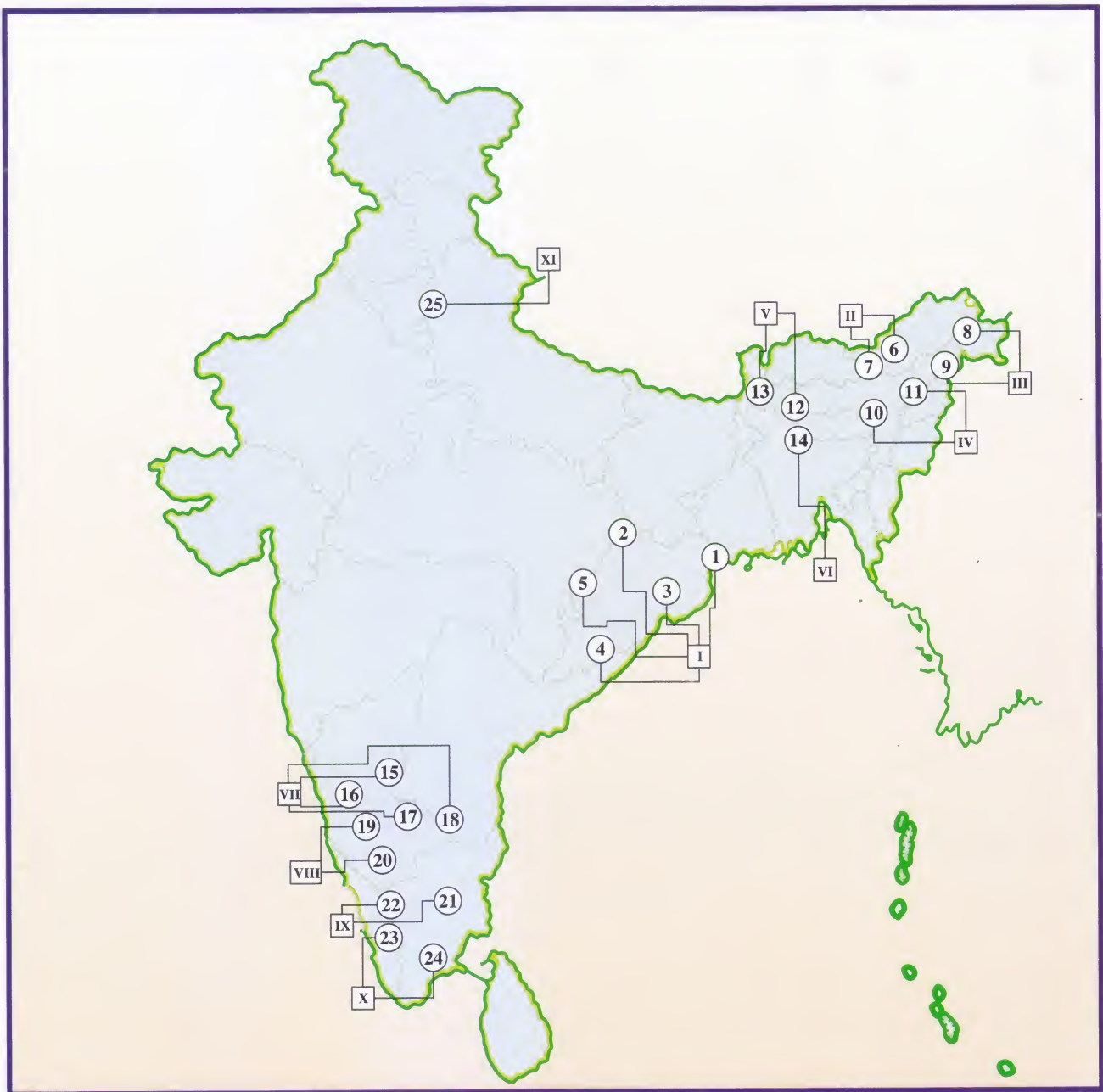




These intelligent creatures have an intimate knowledge of their area!

While feeding along the roadside of Bangalore-Ooty highway in Bandipur one day, it drizzled. These females were quick to realise that water would have collected in the potholes on the road, enough for a small drink.

Elephant Reserves of India



I EASTERN INDIA

1. Mayurjharna
2. Singhbhum
3. Mayurbhanj
4. Mahanadi
5. Khalasuni

II NORTH BRAHMAPUTRA

6. Kameng
7. Sonitpur

III SOUTH BRAHMAPUTRA

8. Dibru
9. Deomali

IV KAZIRANGA

10. Kaziranga-Karbi Anglong
11. Intanki

V EASTERN INDIA

12. Manas
13. Buxa-Jaldapara

VI GARO-HILLS

14. South Garo Hills

VII NILGIRI-EASTERN GHATS

15. Mysore
16. Wyanad
17. Mudumalai
18. Kaundinya

VIII SOUTH NILGIRI

19. Nilambur-Silent Valley
20. Coimbatore

IX. WESTERN GHATS

21. Anaimalai
22. Parambikulam
- X. PERIYAR
23. Periyar

X. PERIYAR

24. Madurai

XI. NORTHERN INDIA

25. Shivalik

Table 1. ESTIMATED POPULATION OF WILD ELEPHANTS IN INDIA – 2001.

<i>Region</i>	<i>State</i>	<i>Elephant population</i>	
		<i>Minimum</i>	<i>Maximum</i>
NORTH-EAST	Arunachal Pradesh	1607	1607
	Assam	5312	5312
	Meghalaya	1840	1840
	Nagaland	147	147
	Mizoram	28	28
	Manipur	10	15
	Tripura	60	85
	West Bengal (North)	292	292
Total for North-East		9296	9326
EAST	West Bengal (South)	35	35
	Jharkhand and Bihar	618	618
	Orissa	1827	1827
Total for East		2480	2480
NORTH	Uttaranchal and Uttar Pradesh	1000	1984
Total for North		1000	1984
SOUTH	Tamil Nadu	2971	2971
	Karnataka	6088	6088
	Kerala	5737	5737
	Andhra Pradesh	73	73
Total for South		14869	14869
ISLANDS	Andaman and Nicobar	40	70
GRAND TOTAL		27685	28729

Table 2. ANNUAL CENSUS REPORT OF WILD ELEPHANTS IN KARNATAKA (1997-1998).

Sl.No.	Name of Circle	Name of Division	No. of Elephants
1.	Bangalore Circle	Bangalore Rural	37
		Bangalore Urban	-
		Kolar	-
		Total for Bangalore Circle	37
2.	Bellary Circle	Bellary	-
		Chitradurga	-
		Total for Bellary Circle	-
3.	Belgaum Circle	Belgaum	71
		Ghataprabha	-
		Bagalkot	-
		Total for Belgaum Circle	71
4.	Kanara Circle	Sirsi	-
		Haliyal	45
		Yellapur	3
		Honavar	1
		Karwar	3
		Total for Kanara Circle	52
5.	Gulbarga Circle	Gulbarga	-
		Bidar	-
		Raichur	-
		Total for Gulbarga Circle	-
6.	Hassan Circle	Hassan	-
		Tumkur	-
		Total for Hassan Circle	-
7.	Kodagu Circle	Madikeri	-
		Mangalore	61
		Kundapura	-
		Total for Kodagu Circle	61
8.	Mysore Circle	Mysore	-
		Kollegal	-
		Hunsur	-
		Mandya	-
		Total for Mysore Circle	-
9.	Shimoga Circle	Shimoga	27
		Bhadravati	-
		Sagar	-
		Chikmagalur	20
		Koppa	6
		Total for Shimoga Circle	53
10.	Wildlife North Circle Shimoga	Bhadra Wildlife Division	203
		Shimoga Wildlife Division	-
		Kudremukh Wildlife Division	4
		Dandeli Wildlife Division	45
		Dharwad Wildlife Subdivision	-
		Total for Wildlife North Circle	252
11.	Wildlife South Circle Mysore	Hunsur Wildlife Division	707
		Chamarajanagar Wildlife Division	645
		Madikeri Wildlife Subdivision	-
		Mysore Wildlife Subdivision	-
		Total for Wildlife South Circle	1352
12.	Project Tiger, Mysore	Project Tiger Division, Gundlupet	3471
		Total for Project Tiger Mysore Division	3471
13.	Bannerghatta National Park and Cauvery Wildlife Division	Bannerghatta	52
		Cauvery Wildlife Division, Kanakapura	697
		Total for Bannerghatta and Cauvery Division	749
GRAND TOTAL			6098

Table 3. ELEPHANT RESERVES IN INDIA (Revised List – 2001).

Sl.No.	Elephant Reserve	State Elephant Reserve	State	Area (km ²)	Elephant Population
I	Eastern India (South West Bengal – Jharkhand – Orissa)	1. Mayurjharna	West Bengal	450	60
		2. Singhbhum	Jharkhand	4200	350
		3. Mayurbhanj (Simlipal-Kuldiha-Hadgarh)	Orissa	3200	500
		4. Mahanadi	Orissa	1000	550
		5. Khalasuni	Orissa	500	100
	<i>Total</i>			9350	1560
II	North Brahmaputra (Kameng – Sonitpur)	6. Kameng	Arunachal Pradesh	4300	1580
		7. Sonitpur	Assam		
III	South Brahmaputra (Dibru – Deomali)	8. Dibru	Assam	4400	500
		9. Deomali	Arunachal Pradesh		
IV	Kaziranga (Kaziranga – Karbi Anglong – Intanki)	10. Kaziranga-Karbi Anglong	Assam	4900	1800
		11. Intanki	Nagaland		
V	Eastern Dooars (New)	12. Manas	Assam	3800	800
		13. Buxa-Jaldapara	West Bengal		
VI	Garo Hills (Balphakram)	14. South Garo Hills (Balphakram)	Meghalaya	2900	1700
VII	Nilgiris – Eastern Ghats	15. Mysore	Karnataka	13000	6300
		16. Wyanad	Kerala		
		17. Mudumalai	Tamil Nadu		
		18. Kaundinya	Andhra Pradesh		
VIII	South Nilgiri (Nilambur – Silent Valley – Coimbatore)	19. Nilambur-Silent Valley	Kerala	2400	950
		20. Coimbatore	Tamil Nadu		
IX	Western Ghats (Anaimalai – Parambikulam)	21. Anaimalai	Tamil Nadu	5700	1600
		22. Parambikulam	Kerala		
X	Periyar (Periyar – Madurai)	23. Periyar	Kerala	3300	1500
		24. Madurai	Tamil Nadu		
XI	Northern India (Rajaji – Corbett)	25. Shivalik (Rajaji-Corbett)	Uttaranchal	3000	750
TOTAL				57050	19040

Table 4. ELEPHANT MORTALITY IN KARNATAKA – No. of cases detected

Year	Natural cases	No. of cases in which ivory was recovered	Accidental cases	Poaching cases	No. of cases in which ivory was recovered	Total no. of deaths
1990-91	45	11	3	10	2	58
1991-92	21	3	3	14	2	38
1992-93	34	2	4	16	Ivory stolen in all cases	54
1993-94	60	4	6	11	1	77
1994-95	56	5	8	18	1	82
1995-96	54	9	14	11	2	79
1996-97	90	20	20	16	Ivory stolen in all cases	126
1997-98	42	17	6	24	Ivory stolen in all cases	72
1998-99	42	13	11	22	3	75
1999-2000	98	43	8	18	Ivory stolen in 17 cases	124
2000-2001	74	15	8	18	Ivory stolen in all cases	100
TOTAL	616	142	91	178	11	885



The trunk combines great strength with amazing sensitivity. With it, the elephant can almost absent-mindedly perform tasks which would otherwise require a dozen strong men.



Sixty thousand muscles manipulate the elephant's six foot long, one foot thick trunk



